THREAD HERRING DISTRIBUTION OFF FLORIDA'S WEST COAST

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The thread herring (Opisthonema oglinum) is essentially a coastal pelagic species. Data suggest a seasonal north-south migration along Florida's Gulf coast almost entirely within state territorial waters (nine nautical miles from shore).

Abundance in major estuarine systems varies seasonally. Commercially valuable concentrations of thread herring occur near Ft. Myers, Florida, during the winter. The prospects for a commercial fishery are discouraging because legislation now prohibits the use of purse seines in state waters and because thread herring are not abundant outside state waters.

The thread herring is a migratory clupeid often found in abundance along Florida's Gulf coast. Bullis and Thompson estimated in 1967 that stocks in the Gulf of Mexico may approach one million tons; Sykes suggested in 1968 that the resource might sustain an annual catch of 500,000 tons.

Attempts have been made to harvest winter concentrations near St. Petersburg and Ft. Myers, Florida (Butler, 1961; Fuss, 1968). Although the fishery has developed within Florida state waters (nine nautical miles offshore) and is under state jurisdiction, the resource has national interest: 1) the fish are migratory; 2) the fish products are distributed in interstate commerce; and 3) the entire nation benefits from the utilization of domestically produced fish meal and oil.

The National Marine Fisheries Service (formerly Bureau of Commercial Fisheries) anticipated an important fishery. It began studies in 1967 to insure a sound base for eventual management of the fishery. Recent state legislation, however, has effectively closed the fishery by prohibiting the use of purse seines in waters along much of Florida's Gulf coast.

Close contact was maintained with industry as the fishery developed. Plant operators and fishermen were very cooperative in providing biological samples and catch statistics. They followed our research with interest. This report summarizes ours and other data related to thread herring distribution along Florida's Gulf coast.

SOURCES OF DATA

We sought to achieve a synoptic view of the range and movements of thread herring along Florida's Gulf coast. We reviewed data from many sources: progress, cruise, aerial-survey reports, and unpublished data from Exploratory Fishing and Gear Research Base Pascagoula, Mississippi; log-book data and aerial surveys from fishing industry; statistical data developed by the National Marine Fisheries Service; and unpublished aerial survey reports by Florida's Department of Natural Resources.

We plotted catch records and aerial sightings by latitude and longitude without reference to date of collection and observation and made no attempt to include vessel or flight

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tracks. Although this procedure obscured year-to-year changes in distribution, it provided a record of historic range.

To determine the distribution of thread herring in Tampa Bay and adjacent areas, we systematically collected fish in gill nets at a series of fixed stations (Figure 1). In Tampa Bay, stations were selected to assess the importance of an estuary as a sanctuary and as a reservoir for the coastal fishery. Inshore stations between Ft. Myers and St. Petersburg were occupied to determine the winter distribution of thread herring northward of the commercial fishery (Fuss, Kelly and Prest, 1969). In the St. Petersburg area, we established a transect or line of stations offshore to estimate the distribution pattern within and beyond state waters. The state boundary, nine nautical miles offshore, was located midway along the transect.

Our standard unit of effort for all stations was a two-inch mesh (stretch measure) monofilament gill net, 300 x 10 feet, fished for 30 minutes. A gill net 20 feet deep, same size mesh and length, divided lengthwise with a spacer at 10 feet, provided the equivalent of two units of effort fished simultaneously at different depths. The catch per unit of effort was calculated for each 10-foot section. From January to July 1970, we sank an additional unit of gear at each transect station beyond three miles to insure getting thread herring below 20 feet.

DEVELOPMENT OF COMMERCIAL FISHERY

Incidental catches of thread herring in the Gulf menhaden fishery were first noticed in 1948 (Miles and Simmons, 1950; Christmas, Gunter and Whatley, 1960). During the next eight years, fishermen had little interest in thread herring because they were harder to catch than menhaden and were not generally available on menhaden grounds. However, after Gulf menhaden landings slumped over 30% in 1957, the industry began to investigate alternate resources (Butler, 1961). NMFS cruise and aerial-survey reports convinced some people in the menhaden industry that commercial quantities of thread herring were concentrated along Florida's Gulf coast during the winter.

In fall 1958, NMFS began experimenting with lampara seines near St. Petersburg to correct deficiencies noted earlier when this gear had caught thread herring for a baitfish fishery. In hopes of lowering costs of catching menhaden, segments of the menhaden fishery also began experimenting with lampara seines. These experiments were inconclusive during the 1958-59 menhaden season. They were shifted to the St. Petersburg area where thread herring stocks were available. More gear modifications by NMFS produced thread herring catches as great as 27 tons per set.

In turn, this demonstration of resource availability stimulated experiments with the standard 2-boat purse-seine technique. These were expanded in 1959-60 to include the single-boat purse-seine technique. The single-boat method produced thread herring catches ranging from 5 to 40 tons per set. But, by 1960, the Gulf menhaden fishery had recovered from the 1957 slump and produced record landings in excess of 400,000 tons. Interest in thread herring declined.

In 1966, NMFS aerial surveys and exploratory fishing cruises again indicated that thread herring were abundant. They occurred in more catch samples and were sighted more often than all other surface-schooling species combined (Bullis and Thompson, 1967). The development of a commercial fishery was encouraged by demonstration of the availability and size of the resource along the west coast of Florida (estimated at 750,000 tons by Bullis and Thompson, 1967) and indications of declining Atlantic menhaden catches (Nicholson, 1966). In 1967, a reduction plant was opened in Charlotte Harbor near Ft. Myers, Florida (Fuss 1968). The Florida west coast fishery, plagued by legal and other difficulties, remained small. It produced about 3,900 tons in 1967, 6,000 tons in 1968, and 2,800 tons in 1969. Virtually all fish were caught within the 10-fathom curve, between Latitude 26° N. and 27°N. Legal restrictions prohibited fishing off St. Petersburg, Florida. Rough bottom inhibited purse seining further north or south of these latitudes.

THREAD HERRING DISTRIBUTION

For the fishery, knowledge of the distribution of thread herring with regard to legal boundaries became as important as knowledge of the seasonal distribution. From July 1969 to June 1970, we made 73 gill net sets totaling 157 units of effort (Figure 1). Sixty-three

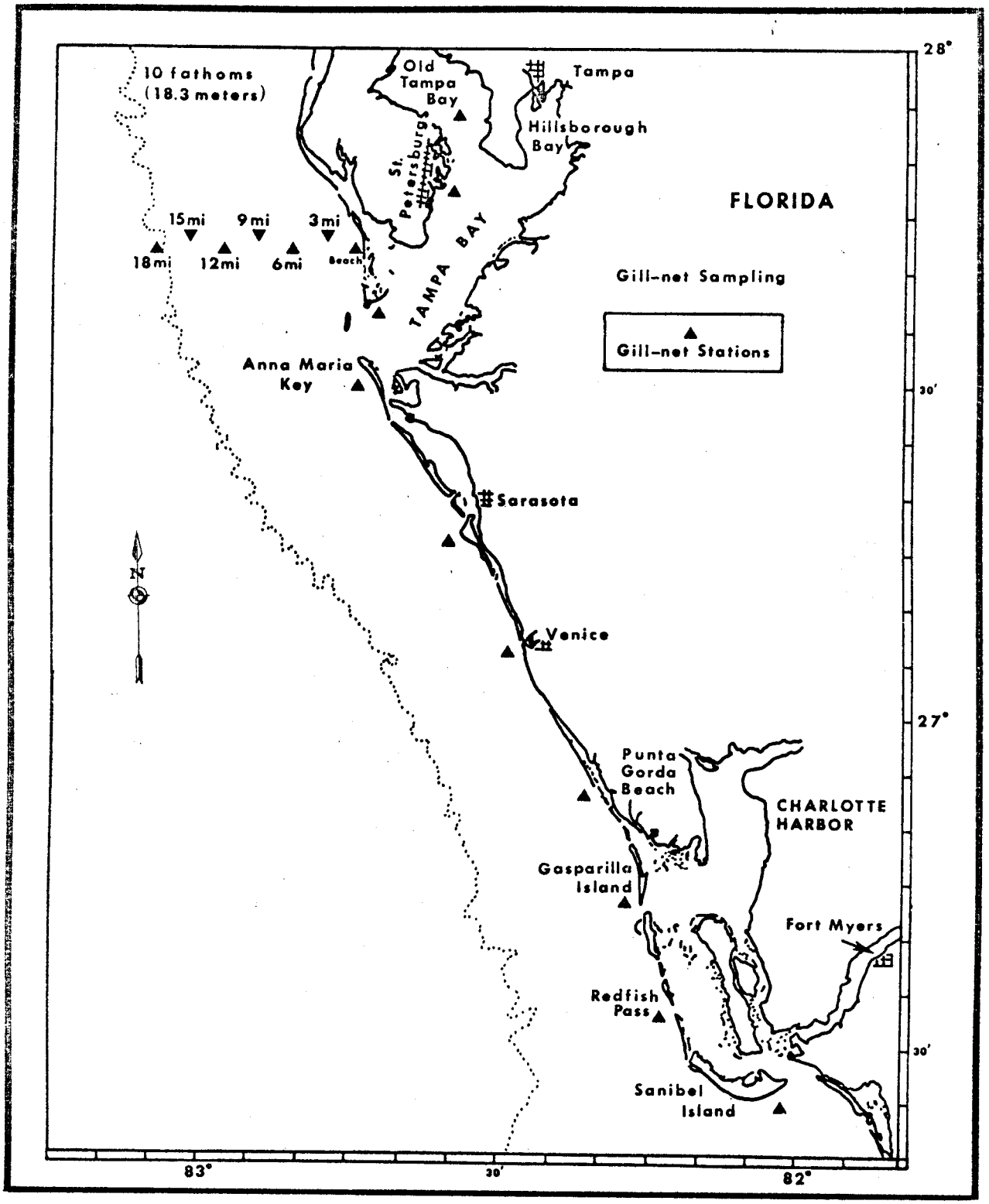

Fig. 1 - Locations of gill-net stations from Tampa Bay to Sanibel Island, Florida.

percent of the effort, or 99 units, was distributed among the four stations within state waters; the balance, 37%, or 58 units, was distributed among the three stations outside state waters. The catch for all stations was 2,683 fish; with the exception of one fish, all were caught within or at the state boundary. The distribution of catch and effort by station (Figure 2) clearly illustrates the coastal nature of the stock within state waters. The nearshore distribution is emphasized further by plots of aerial sightings (Figure 3) and NMFS exploratory catches from research vessels (Figure 4). Only three of 68 aerial sightings were logged in waters deeper than 10 fathoms; only one of 76 exploratory catches was made beyond the 10-fathom curve.

The occasional capture of thread herring in bottom trawls during NMFS cruises suggested distribution throughout the coastal water column. By using the 20-ft. gill net on the surface, and the 10-ft. gill net on the bottom, we were able to fish at least 85% of the water column at transect stations within state waters, and about 50% of water column at stations between state boundary and 10-fathom curve. Thread herring used the entire water column, but their distribution was not uniform. A decreasing catch per unit of effort generally was associated with increasing depth (Table 1). Thread herring were concentrated in the upper 10 feet of the water column and within six miles of the beach. Failure to catch thread herring on the bottom beyond nine miles (state boundary) during the winter and spring with 12 additional units of gear suggests the fish do not move into deep offshore waters.

Thread herring distribution in the Tampa Bay system appears to be modified by the industrial and domestic pollution that flushes from Hillsborough Bay (Figure 1). Pollution and dredge and fill projects have modified Hillsborough Bay so extensively that 42% of that bay has been classified unhealthy (Taylor, Hall and Saloman, 1970). The effects of pollution extend down Hillsborough Bay into the midsection of Tampa Bay. There, catches per unit of effort were only 8% of catch per unit of effort in Old Tampa Bay, and only 23% of catch in Tampa Bay Pass (Table 2). Our high catch per unit of effort at the Old Tampa Bay station (110 fish) exceeded the catch per unit of effort at all other stations; this indicates that Old Tampa Bay is a useful segment of thread herring range. Within the entire Tampa Bay complex, Old Tampa Bay is also the most productive nursery area for other types of fin fishes (Sykes and Finucane, 1964).

THREAD HERRING MOVEMENT

Butler indicated that thread herring were year-round inhabitants along the Florida Gulf coast between Cape San Blas and Key West. Fuss suggested that during the fall and winter thread herring move southward along the coast and concentrate near Ft. Myers. Fuss, Kelly and Prest found that effort on the fishing grounds also shifted south as winter progressed.

An increase in the catch per set corresponded with the shift in effort. It suggests that school size increases as population shifts. The increase in school size appears related to temperature; during the winter, it forces the population into a restricted area in advance of the 68° F. isotherm. Data from gillnet stations between Sanibel Island and St. Petersburg (Figure 1) confirm that thread herring leave the inshore waters north of Ft. Myers and move south as temperatures fall below 68° F. (Table 3). Yearly variations in the onset, severity, and duration of cold weather govern the rate and extent of southerly movement. Commercial quantities of thread herring are seldom found in water colder than 68° F., temperatures that are common north of Ft. Myers during the winter.

No thread herring were taken by gill nets off St. Petersburg during winter 1967 after surface temperatures dropped below 63° F. However, catches of thread herring in gill nets increased in the spring. The mean catch per unit of effort peaked when the temperature ranged between 81° F. and 84° F.

In 1970, thread herring returned to the St. Petersburg area by late February. They were collected at transect stations six and nine miles off the beach after surface temperatures began increasing from the January low. By March, surface temperatures had increased to 63° F. Incidental catches were made successively at the 9-mile, 6-mile, and 3-mile stations; this suggests movement toward the beach. The average surface temperature increased to 82° F. in April, and large catches were made at the 3-mile and 6-mile stations. The seasonal increase in catch is shown in Figure 5.

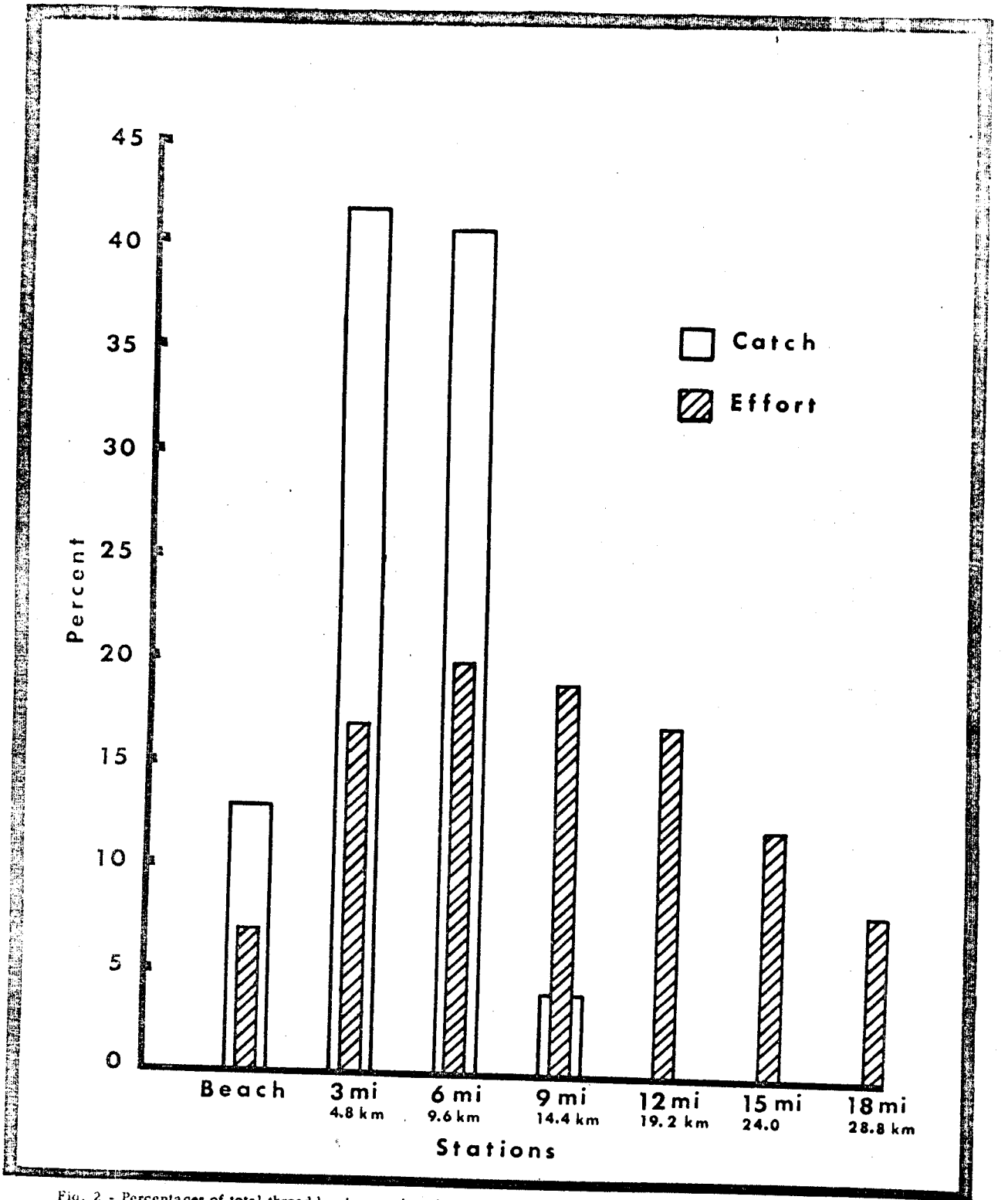

Fig. 2 - Percentages of total thread herring catch and total gill-net effort by transect station off St. Petersburg, Florida.

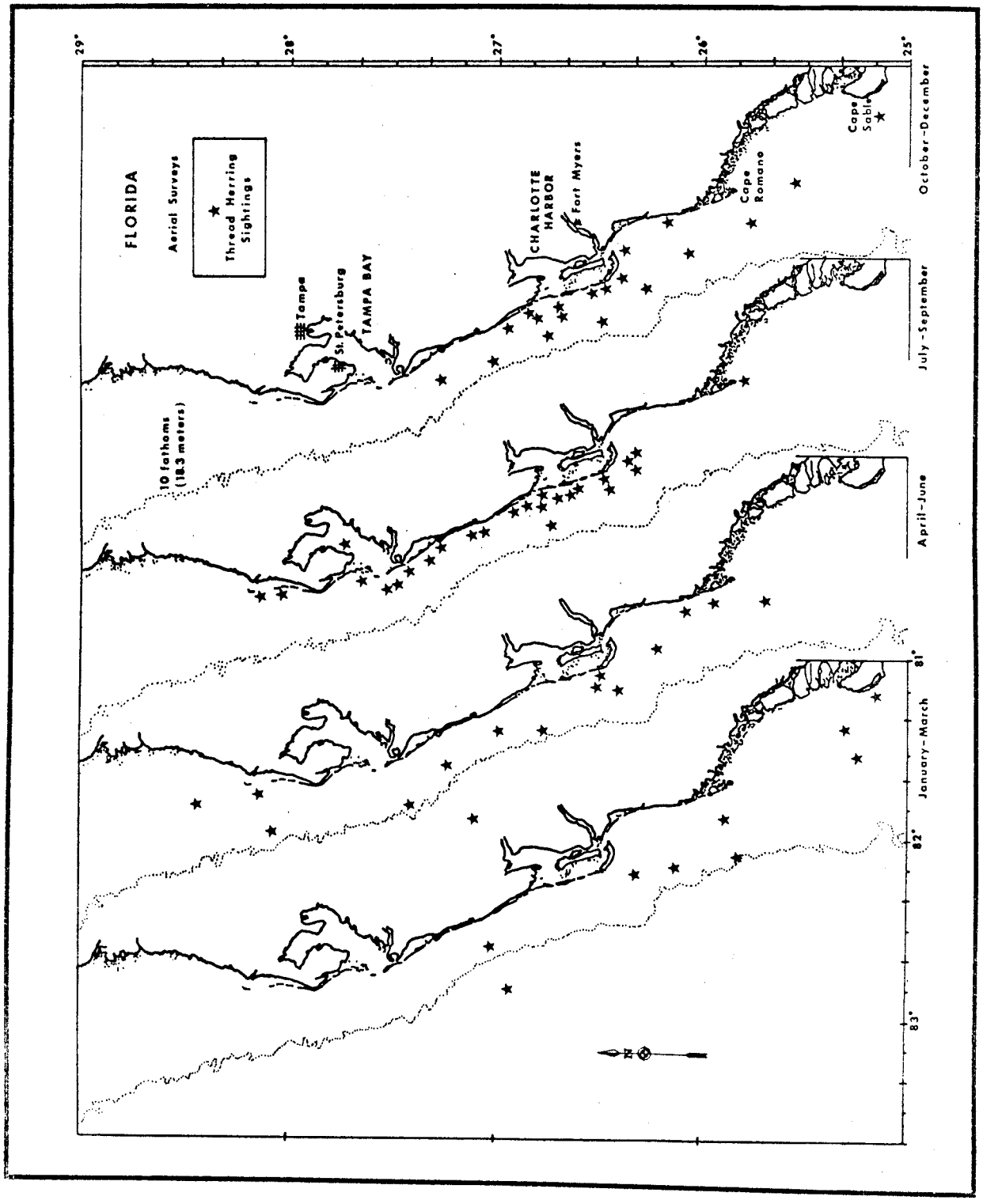

Fig. 3 - Seasonal distribution of aerial sightings of thread herring schools along Florida's Gulf coast.

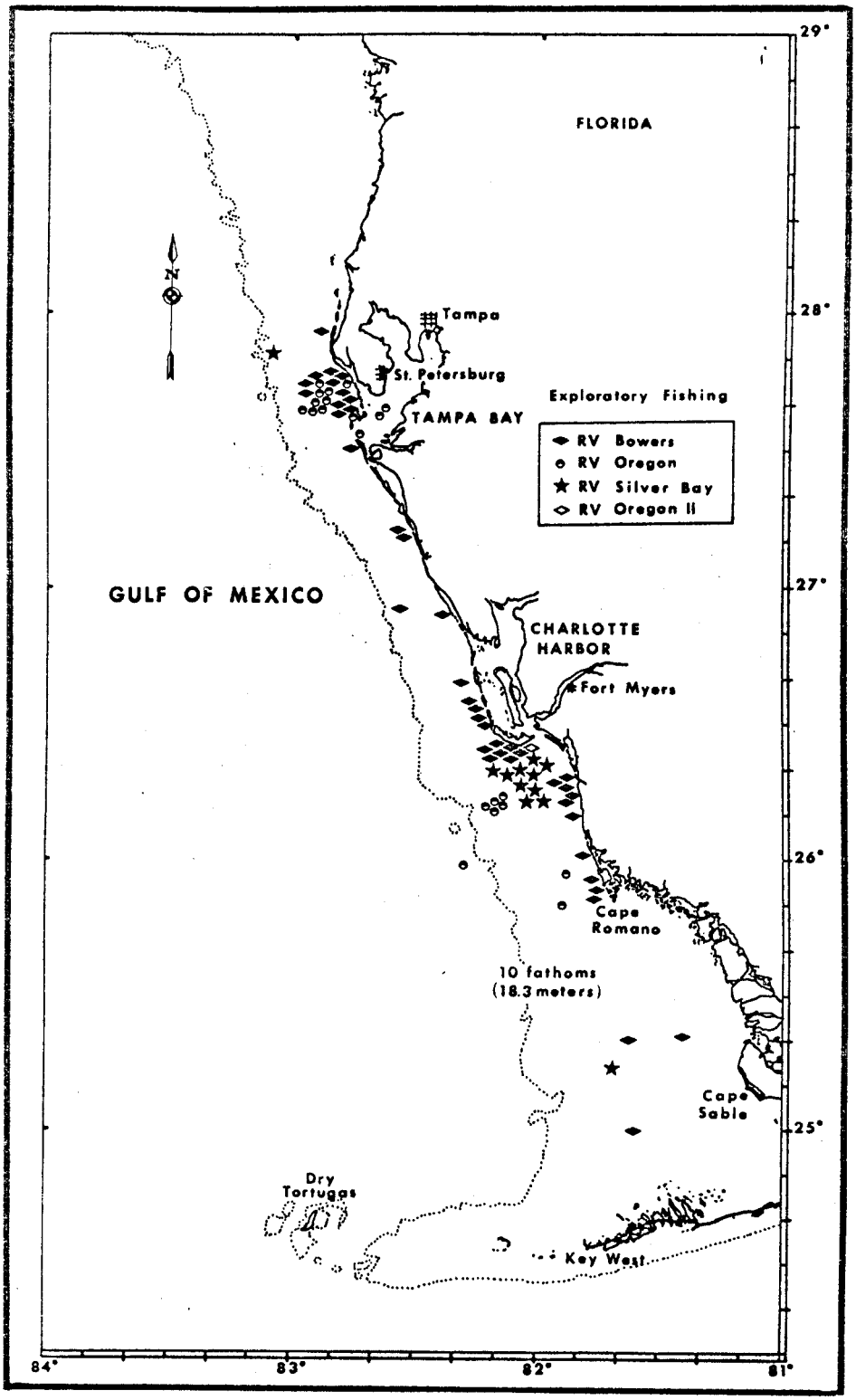

Fig. 4 - Distribution of exploratory catches of thread herring along Florida's Gulf coast.

Table 1.--Vertical distribution of thread herring by season along transect stations at depths of 25, 33 and 37 feet.

		STATIONS								
		3 miles			6 miles			9 miles		
	Season	Catch	Units of effort	C/E	Catch	Units of effort	C/E	Catch	Units of effort	C/E
Surface	Jul-Sep	56	4	14	169	4	42	34	4	9
	Oct-Dec	14	3	5	13	3	4	0	3	0
	Jan-Mar	8	3	3	25	3	8	0	3	0
	Apr-Jun	787	3	262	545	3	182	46	3	15
	Sub Total	865	13	67	752	13	58	80	13	6
Mid-depth	Jul-Sep	26	4	7	104	4	26	7	4	2
	Oct-Dec	14	3	5	14	3	5	0	3	0
	Jan-Mar	8	3	3	10	3	3	1	3	0
	Apr-Jun	195	3	65	172	3	57	0	3	0
	Sub Total	243	13	19	300	13	23	8	13	1
Bottom	Jul-Sep									
	Oct-Dec									
	Jan-Mar	7	1	7	28	2	14	0	1	0
	Apr-Jun				12	3	4	23	3	8
	Sub Total	7	1	7	40	5	8	23	4	6
	Total	1115	27	41	1092	31	35	111	30	4

Table 2.-- Thread herring catches and environmental observations at gill net stations in Tampa Bay.

	Station								
	Old Tampa Bay			Mid Bay			Bay Pass		
Date	C/E	Temp. °F	Sal. ‰	C/E	Temp. °F	Sal. ‰	C/E	Temp. °F	Sal. ‰
10-5-67	317	77.5	24.4	0	77.7	24.7	0	78.6	26.2
11-2-67	33	75.9	25.1	21	76.6	26.7	0	75.0	32.5
1-30-68				0	62.2	28.8	0	60.8	33.2
2-28-68	0	59.0	28.6	0	59.9	29.4	0	57.9	33.0
3-28-68	2	66.7	28.9	2	68.0	29.2	0	66.7	30.5
4-29-68				27	78.8	30.4	28	80.0	34.4
5-22-68	400	82.4	30.1	48	81.9	30.6	433	81.7	34.9
7-31-68	219	90.0	24.9	9	88.5	22.0			
8-21-68				0	89.2	24.0	16	88.5	32.9
10-31-68	0	71.6	22.0	4	70.3	25.0	3	68.7	32.5
1-23-69	0	60.6	23.8	0	62.4	25.2	0	60.8	31.6
7-10-69	125	88.2	27.0	1	89.4	28.5	1	89.4	35.3
9-24-69	2	83.8	22.0	0	83.8	23.4	2	82.9	33.3
Average	110	75.6	25.7	9	76.1	26.8	40	74.1	32.5

*C/E is catch per unit of effort with only one unit of gear fished at each station on each date.

Table 3.-- Thread herring catches and environmental observations at gill net stations between Sanibel Island and St. Petersburg, Florida.

Date	Area	Depth (feet)	Temp. (°F)	Salinity (‰)	Catch/effort*
8-23-67	Gasparilla Island	24	86.1	33.4	62
	Punta Gorda Beach	23	85.8	34.3	19
	Venice Inlet	23	86.3	33.8	2900 (est.)
4-17-68	Sanibel Island	30	74.8	34.8	138
	Sanibel Island	20	76.6	35.0	112
	Redfish Pass	20	77.0	35.1	3
2-7-69	Sanibel Island	19	64.2	34.3	0
	Redfish Pass	20	62.6	34.0	0
	Gasparilla Island	26	63.9	35.1	0
	Punta Gorda Beach	29	64.0	34.8	0
	Venice Inlet	29	63.9	34.8	21
11-25-69	Gasparilla Island	17	66.7	34.1	0
	Gasparilla Island	21	65.7	33.8	0
	Punta Gorda Beach	27	66.2	34.3	0
	Venice Inlet	28	66.0	34.2	0
	Sarasota	31	66.4	34.2	0
	Anna Maria Key	24	65.8	34.2	0

*Only one unit of gear was fished at each station on each date.

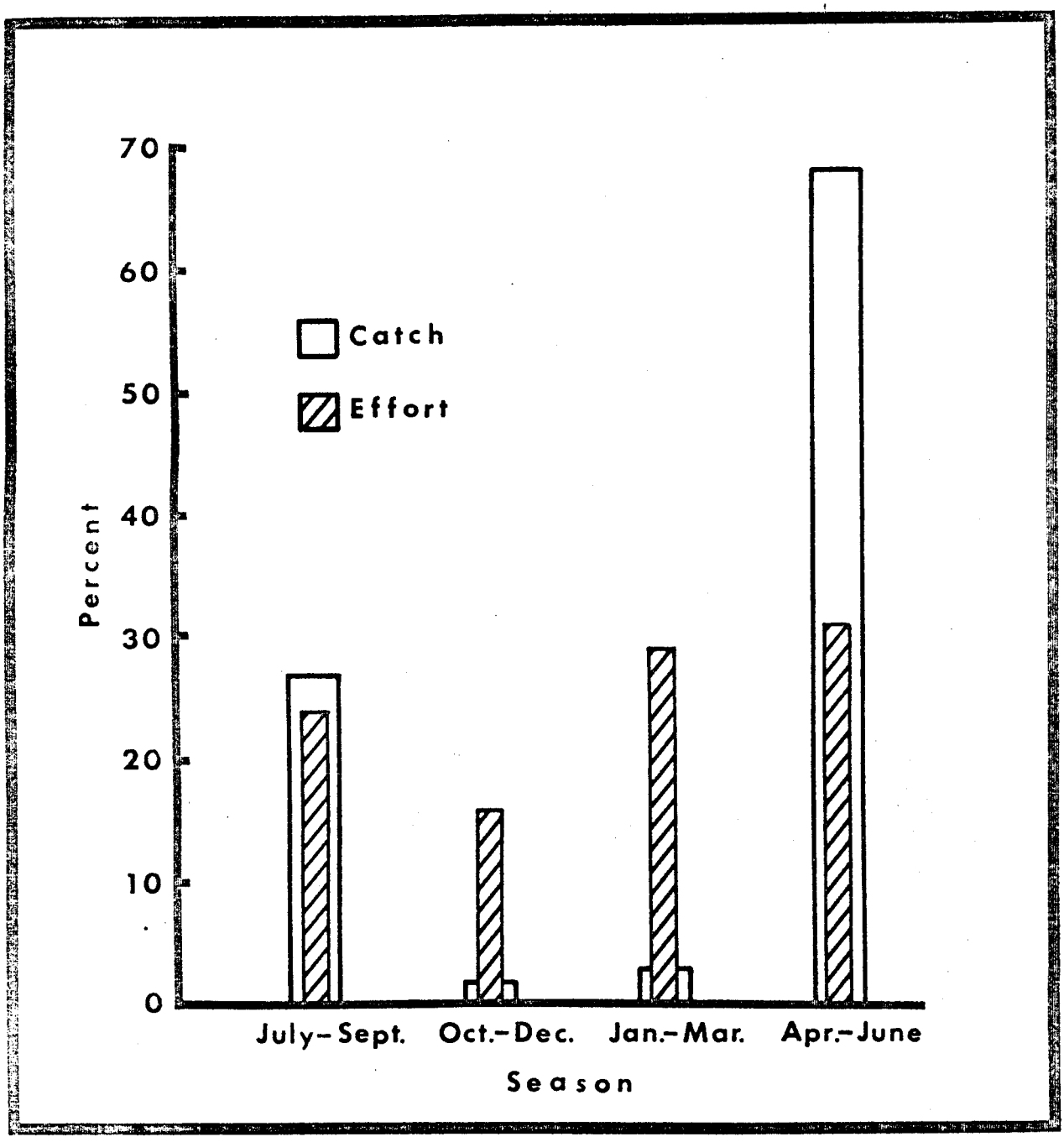

Fig. 5 - Seasonal percentages of total thread herring catch and total gill-net effort from all transect stations off St. Petersburg, Florida.

Although thread herring occur extensively in old Tampa Bay, their occurrence within the entire Bay system is governed by seasonal changes in temperature. They first appear in the Bay during March, almost a month after moving into the Gulf inshore zone off St. Petersburg. During April, May, and June, when temperatures range between 73° F. and 84° F., they are common in the bay. We speculate that the preferred summer temperatures lie between 79° F. and 84° F., and salinities between 32% and 34%. From July to October, the widely varying catches suggest sporadic movement in and out of the bay as temperatures fluctuate above and below 84° F. Declining temperatures in the late fall encourage departure from the bay. Departure is completed in December. We have not collected thread herring in the bay at temperatures below 66° F.; none has been observed in winter kills (Rinckey and Saloman, 1964). Thread herring apparently do not reenter the bay until temperatures again approach 68° F. in March. Thus Tampa Bay serves only as a temporary extension of summer range and is not a permanent year-round refuge.

The migration pattern is distinctly one of southerly inshore movement in autumn initiated by declining water temperatures. Dispersal in a northerly direction begins in early spring soon after water temperatures begin rising.

This migration pattern is similar to that demonstrated along the Atlantic seaboard, where tag returns indicate a northward movement along the coast in spring and a southward movement in fall. The rate of movement for thread herring along the Atlantic coast may exceed six miles per day. (Randall Cheek, NMFS Beaufort, N.C.)

SUMMARY AND CONCLUSIONS

The thread herring resource along Florida's Gulf coast contains as much as 750,000 tons of fish. The fish migrate seasonally in a north-south pattern, almost entirely within Florida's territorial waters. Florida, therefore, is responsible for regulation of the resource harvest.

Limited operation of a fish-meal plant in Charlotte Harbor established thread herring as a valuable source of domestic fish meal and a potential source of high-quality protein for human consumption. Although the fishery is now closed, present fishing restrictions will not stockpile this renewable resource because its size will fluctuate naturally. Without an economic incentive for studying thread herring, the causes of natural fluctuations cannot be determined.

Annual changes in the onset, severity, and duration of cold weather affect the rate of the north-south migration and the degree of fish concentration. Thread herring generally migrate south in advance of declining temperatures (68° F. isotherm) and begin movement northward as surface temperatures increase from the winter low. Because schools are found most often within six miles of shore, the prospects for a commercial purse seine fishery beyond state jurisdiction are poor.

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